Smart Mirror Design using Raspberry Pi

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Abstract: Information is needed to integrate smart mirror technology and into one’s daily schedule. As the mirror is in place, the user will get interaction and information during their routines like weather data, day highlights, motivational quotes. Data can be viewed in the mirror during routines, which saves the user time. This paper provides a working prototype, i.e. design and development of a smart mirror using Raspberry Pi 3 for the home environment and for commercial use in various industries. Since the microcontroller is cooled using a cooling fan. To display information in the mirror, the setup is provided with a network connection, which displays the latest information. Look at the acrylic sheet through the mirror for the entire setup display is placed on the back. If the mirror is useful for this purpose, imagine that it would be very useful. The device looks like a normal mirror but with a screen inside. It collects real-world machine data such as location-based latest news and headlines, weather reports and local time display. Smart mirror makes life easier by saving time.

Index Terms: Raspberry Pi 3, Acrylic sheet, Smart mirror.

I. INTRODUCTION

Over the past few years, technology has become an important and indispensable part of our daily routine. As technology is rapidly evolving, people expect to become more productive and e-centric in their daily activities. The use of smart phones, tablets, laptops and other similar devices has provided tools that help people stay productive and most importantly time efficient.[1] The design is to introduce a multipurpose mirror that is intended to fill in as both enrichment and data source. With a single glance at the mirror, there will be basic information on what to wear based on the weather forecast for the day or how much time they have left if they want to arrive on time for their intended destination.

Interactive computing, with embedded devices connected to wireless, is used in a variety of everyday activities, changing and improving living standards. Based on these interactive computing and communication technologies, now many devices have emerged. Multimedia intelligence can provide convenient, secure and personal services everywhere. This makes convenient for many users whether for domestic or for industries. It is used as Design and development of interactive multimedia futuristic smart mirror with artificial intelligence for ambient home environment, as well as commercial uses in various industries.

Smart mirror provides an effortless experience that allows the user to walk and is usually greeted with information that they need another device. The use of smart mirror is to increase their productivity by saving user time.

II. LITERATURE SURVEY

There are significantly more products than actual products. Some may blame it on the fact that the smart home is still a growing market and is limited by manufacturing costs without making products available from everyday consumers. The fact that there are more products shows interest in developing a more affordable and functional smart mirror.[2] However, even if the actual products developed by a company are distributed on features, they are still in the development stage or are already considered a viable competitor at a much higher price. Few of them are—

i) Interactive Mirror

Touch the built-in touchscreen mirror to keep the user interactive.[3] Unlike our smart mirror, only one point of touch is detected because it mimics a mouse.

ii) Magic Mirror

Magic mirror utilizes TV with mirror. By using Microsoft Kinect, it can track movement of the person who interact, and voice is also recognized.[4]

iii) The Android-powered Mirror

In this, the LCD screen secured with hazy intelligent glass is utilized to make the mirror. The mirror contains applications, for examples, climate, news, weight, temperature and water stream [5]. Water stream is an intriguing expansion and is brilliant at helping water preservation.

iv) Memomi

Memory mirror is abbreviated as Memomi. It is another innovative mirror on the rundown. At present accessible is magic mirror, otherwise it is called as Memomi [6]. It is being utilized as a substitution for changing areas in shops that sell garments. Clients can collaborate with the mirror through the versatile application.
I. Introduction

The summary of existing methods is shown in above table I. In contrast with the works depicted over, proposed work is diverse in that we intend to build up a working framework for offering types of assistance in the home climate dependent on web server principles and off-the-rack innovation, where the savvy reflect is the interface to get to or control different information takes care of, different data administrations.

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<tr>
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II. Proposed Method

The proposed technique means to give users an intuitive interface for streamlined and customized services in the solace of the home of the user. It is smart and easy to use arrangement as a mirror that likewise goes about as a gateway to intelligent services. For example, multimedia and news sources are among others.

PC Specifications:

A computer is used in smart mirror, which takes the input data from the various peripherals. It is made up of a mini ITX Intel motherboard. This motherboard has the features like- USB ports, HDMI port and audio ports, etc. Intel i3 processor with graphics card included. The following table II gives the hardware specifications for this computer.

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<tr>
<td>CPU</td>
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</tr>
<tr>
<td>Solid State Drive</td>
<td>64GB</td>
</tr>
<tr>
<td>Power Supply</td>
<td>380 watts</td>
</tr>
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System Requirements:

To control the mirror, the microcontroller is used, and the segments utilized should be powered by a 5V power gracefully.

The framework utilized in the mirror
- Should have the option to interface with a Wi-Fi interface just as a PC show.
- Should have the option to take user contribution to program the user’s location and switch what information is being shown on the auxiliary screen [7].
- Hardware components should fit inside the mirror size [8].

The total system will likewise be mounted on a wall, so there should be an edge assembled that can uphold this weight. Also, the system utilized in the mirror should have the option to interface with a Wi-Fi interface just as numerous LCD shows. The Wi-Fi should have the option to work inside a home, so it should be sufficiently touchy to get the signal from a home Wi-Fi switch. [9]

A. Design

Hardware part mainly consists of:
- Raspberry Pi
- Power Supply
- Monitor
- Wi-Fi
- Cooling Fan

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TABLE I.
SUMMARY OF EXISTING METHODS

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TABLE II.
COMPARISON OF PROPOSED MIRROR WITH EXISTING MIRRORS

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<tr>
<th>Feature</th>
<th>Interactive mirror</th>
<th>Magic mirror</th>
<th>Android-powered mirror</th>
<th>Memomi</th>
<th>Proposed mirror</th>
</tr>
</thead>
<tbody>
<tr>
<td>OS</td>
<td>Windows 10</td>
<td>Linux OS</td>
<td>Android</td>
<td>Customized</td>
<td>Raspbian OS</td>
</tr>
<tr>
<td>App Requirement</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Touchscreen</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Weather update</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Automatic sleep</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Social networking</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>
Raspberry Pi is also known as, RPi. It is a progression of little single-board PCs created in the UK by the Raspberry foundation to advance educating of essential software engineering in schools and in some nations.

Raspberry Pi3 board uses +5V USB power supply. The general purpose I/O(GPIO) pins of RPi board can just securely draw 16mA. The HDMI port uses 50mA, the camera module requires 250mA. The keyboard’s and mouse’s current range is 100mA to 1000mA.

The monitor is used to display the data, which is connected to Raspberry Pi board. Wi-Fi is commonly a locally situated switch. It fetches up to date information such as weather forecasting, news, etc.

Cooling Fans are utilized to draw cold air from an external perspective, remove warm air from within, and move air through heat sink to cool the element. These fans normally come in standard sizes and available in 3-pin and 4-pin connectors. These are used to cool in PCs and the microcontroller., which runs continuously.

The CPU of Raspberry Pi is indicated to run between 40°C to 85°C. If that CPU temperature surpasses 82°C, at that point the CPU’s clock speed will be eased back until the temperature dips under 82°C.

The Block diagram for designing hardware is as shown in the figure1.

The properties that can be configured are:

<table>
<thead>
<tr>
<th>Choice</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Port</td>
<td>The smart mirror server running port and its default value is 8000.</td>
</tr>
<tr>
<td>Address</td>
<td>Interface IP address that accepts connections. The default address is local host, which prevents the built-in webserver from being exposed to machines on the local network. To expose to other machines, use 0.0.0.0.</td>
</tr>
<tr>
<td>IPWhiteList</td>
<td>It gives the list of IPs that allowed to access the proposed smart mirror. The default address is “127.0.0.1”, “::127.0.0.0.1”, “::1”, which is only from the local host. Also configure IP ranges with subnet masks “127.0.0.1”, “127.0.0.1/24” (or) “127.0.0.1”, “192.168.2.1”, “127.0.0.1/24”, “192.168.0.100”.</td>
</tr>
<tr>
<td>Zoom</td>
<td>It allows the user to scale mirror contents with a given zoom factor. The default value is 1.</td>
</tr>
<tr>
<td>Language</td>
<td>It gives the language of interface.</td>
</tr>
<tr>
<td>TimeZone</td>
<td>A form of time notation is used. The possible values are 12 hours or 24 hours format. Default value is 24 hours.</td>
</tr>
<tr>
<td>unit</td>
<td>Unit used in default weather modules. The possible values are imperial or metric. Default is metric.</td>
</tr>
<tr>
<td>module</td>
<td>It gives the array of active modules. These modules must have objects in range.</td>
</tr>
<tr>
<td>customCSS</td>
<td>It gives the path. The default is css/custom.css</td>
</tr>
<tr>
<td>electronOpti ons</td>
<td>This function is used to configure the browser screen size and position i.e. fullscreen, width, height, etc.</td>
</tr>
</tbody>
</table>
The following modules are open source modules. They installed by default.

- Clock
- Calendar
- Present Weather
- Weather Forecast
- Email
- News Feed
- Compliments

**Clock:**

It is an open source module. It gives information about current date and time. The information will be updated real time.

There are some properties to be configured like time Format, display Seconds, clock Bold, show Period, show Date, show Week, date Format, display Type, time zone, seconds Color, etc.

**Calendar:**

The "calendar" module displays events from a public and is also open source. It is also capable of combine multiple calendars.

The properties configured are:
Calendars, date Format, date End Format, show End, time Format, full Day Event Date Format, urgency, etc.

**Present Weather:**

This module shows the current climate, including the windspeed, the dusk or dawn time, the temperature and a symbol to show the current conditions. This one is also an open source.

The configuration options are- url, symbol, color, repeating Count Title, maximum Entries, maximum Number of Days Auth, symbol Class, title Class, time class, etc.

**Weather Forecast:**

This weather module shows the climate forecast for coming week, including a symbol to show the current conditions, the base temperature and the greatest temperature.

The configuration options are- location, locationID, units, roundTemp, degreeLabel updateInterval, animationSpeed, timeFormat, showPeriod, showPeriodUpper, showWindDirection, showWindDirectionAsArrow, showHumidity, showIn doorTemperature, onlyTemp, lang, etc. Figure 3 shows the weather forecast of last 5 days.

**EMAIL:**

This module displays emails on smart mirror and listens for new incoming emails. When a new email is received, the mirror is updated to display it.

The configuration options are user, password, host, port, tls, authTimeout, numberOfEmails, maxCharacters, fade, etc.

**Newsfeed:**

This is one of the open source modules and it shows news features dependent on the RSS channel. Looking through news features happens time sensitive however can likewise be constrained by sending news source explicit warnings to the modules. Collaborating with the module, warning systems permits to send notices to the newsfeed module.

The configuration options are- showTitleSource, showPublishDate, showDescription, wrapTitle, maxNewsItems, startTags, endTags, scrollLength, logFeedWarnings, etc.

**Compliments:**

This module shows a random compliment on the mirror.

The configuration options are- update Interval, fade Speed, compliments, remote File, classes, morning Start Time, morning End Time, afternoon Start Time, afternoon End Time, etc.

**B. Performance measures**

By using following functions, the performance of proposed smart mirror is computed.

- **ShowToast** (msg, dur)- gives a message on the bottom part of the screen during the indicated duration.
- **ShowAlert** (title, msg, IDalert)- gives the alert message that the user can select using gesture input with alert ID.
- **SetTitle** (title)- sets the status bar message.

An API was used which is made by Google, has 50 query a day limit but it is the best one available. To use the API the user, need to make an HTTP POST request with 2000-bit rate.

**C. Results**

This section provides the results of smart mirror. Figure 4 shows current date, current weather status information, and all calendar events. Figure 5 is smart mirror output which gives clock, calendar, email notifications, weather forecastin g, compliments, etc.
IV. CONCLUSIONS

A smart mirror is planned which gives normal communication among clients and the surrounding home administrations. The mirror display is given by an LED monitor which shows all the essential data which are helpful for the client. This mirror also gives a picture-in-picture sub-display to encourage the presentation of services, for example, maps, recordings through youtube. By and large, the model gives an effectively extendable structure that can be used to give significantly greater usefulness to the user. This work will be extended in future (by examining how the surrounding context of the user) and so as to offer ideal assistance encounters in the home climate.

REFERENCES